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EOSDIS Core System Project

Release B Integration and Test Procedures for the ECS Project Volume 2: SDPS

Draft

September 1996

Hughes Information Technology Systems
Upper Marlboro, Maryland

**Release B
Integration and Test Procedures
for the ECS Project
Volume 2: SDPS**

Draft

September 1996

Prepared Under Contract NAS5-60000
CDRL Item 055

SUBMITTED BY

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Preface

This document, intended as a draft submittal, is a contract deliverable with an approval code 2. It does not require formal Government approval, however, the Government reserves the right to request changes within 45 days of the initial submittal. Once this document is approved, Contractor approved changes are handled in accordance with Class I and Class II change control requirements described in the EOS Configuration Management Plan, and changes to this document shall be made by document change notice (DCN) or by complete revision.

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Abstract

The Release B Integration and Test Procedures satisfies the requirements for CDRL Items 055, DID 322/DV3(Release Integration and Test Procedure), as specified in the Statement of Work, as deliverable under the Earth Observing System Data and Information System (EOSDIS) Core System (ECS), Contract NAS5-60000.

The Release B Integration and Test Procedures contains two sub-documents. Volume 1: CSMS Procedures, contains the test cases and procedures primarily to verify the CSMS related Level 3 and Level 4 requirements. Volume 2: SDPS Procedures, contains the test cases and procedures primarily to verify the SDPS related Level 3 and Level 4 requirements. In some cases CSMS or SDPS requirements have been mapped to test cases in Volumes 2 or 1, respectively, to support a more efficient verification approach. This document should be considered as a whole, the CSMS and SDPS volumes serve only to partition the document into manageable size sub-documents for publication.

This is the draft version of the Release B Integration and Test Procedures, Volume 2: SDPS Procedures. This sub-document contains the test cases and selected test procedures to demonstrate SDPS functionality and performance as specified in the Level 3 and Level 4 requirements. This document is intended to provide insight into the consolidated and refined test cases and a sample of the test procedures. This document will be incrementally updated as the remaining procedures are added, refined and delivered according to the schedule in Section 1.4

Keywords: System Integration, Test, I&T, Build, Thread, Release B, Procedures, SDPS, CSMS, ECS

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Abbreviations and Acronyms

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1. Introduction

1.1 Identification

The DID 322/DV2 Release B Integration and Test Procedures for the ECS Project satisfies the requirements for CDRL Items 055, 322/DV3 (Segment/Element Integration & Test Procedures) and 414/VE1 (ECS System Integration & Test Procedures), as specified in the Statement of Work Revision A, as deliverable under the Earth Observing System Data and Information System (EOSDIS) Core System (ECS), Contract NAS5-60000.

1.2 Scope

The Release B Integration and Test Procedures define the plan for integration, test, and verification of ECS Configuration Items, and verifies that ECS complies with the Functional and Performance Requirements Specification (F&PRS), Interface Requirements Documents (IRDs), Level 3 functional requirements (system), Level 4 functional requirements (segment), and the ECS design specifications. The roles and activities of the System Integration and Test (SI&T) Organization are described and schedules for performing Release B activities are provided. There is a separate test plan for the Flight Operations Segment (FOS). Changes and additions to spacecraft and instruments for Release B will be incorporated in later versions of this document.

This is a draft version of the document, delivered by special agreement with the Government. Some of the Phase 1 test procedures are written at a high level. This version of the draft does not include any procedures for the verification of Phase 2 requirements. During the mini-Test Readiness Reviews (TRRs), the appropriate test procedures will be updated/added, as required, to their final form.

The Release B Integration and Test Procedures contains two sub-documents. Volume 1: CSMS Procedures, contains the test cases and procedures primarily to verify the Communication and Management Support related Level 3 and Level 4 requirements. Volume 2: SDPS Procedures, contains the test cases and procedures primarily to verify the Science Data Processing Segment related Level 3 and Level 4 requirements. In some cases CSMS or SDPS requirements have been mapped to test cases in Volumes 2 or 1, respectively, to support a more efficient verification approach. This document should be considered as a whole, the CSMS and SDPS volumes serve only to partition the document into manageable size sub-documents for publication.

This document reflects the Technical Baseline submitted via contract correspondence no. ECS 194-00343.

1.3 Purpose

This is the draft version of the Release B Integration and Test Procedures, Volume 2: SDPS Procedures. This sub-document contains test cases and selected test procedures to demonstrate SDPS functionality and performance as specified in the Level 3 and 4 requirements. This document is intended to provide insight into the consolidated and refined test cases due to ECS organizational and implementation plan changes and a sample of the test procedures. This document will be incrementally updated as the remaining procedures are added, existing procedures are refined, and the document delivered according to the schedule in Section 1.4.

1.4 Status and Schedule

This is the draft version of the ECS Release B Integration and Test Procedures. This document contains the Segment and System test cases revised due to ECS organizational and implementation plan changes. A mapping of the test cases from the Release B System Integration and test Plans (319-CD-006-001/ 402-CD-003-001) to the test cases in this document are provided in Appendix B. Once approved this document supersedes the respective System and Segment Integration and Test Plan. Future changes to the Release B test cases and procedures will be reflected in this document.

Several more formal releases are scheduled for this document. At TRR, the document is released containing test procedures for all Release B test cases. Prior to the Release Readiness Review (RRR), the document is released containing the “as executed” test procedures for all Release B test cases.

Updates to test cases and procedures will be delivered at the appropriate mini-TRR, as needed, for each of tests described in this document. These updates are considered working versions of this document and are released informally on an “as required” basis.

1.5 Organization

This document is organized into 5 sections and 5 appendices:

- | | |
|-----------|--|
| Section 1 | The Introduction contains the identification, scope, purpose, status, schedule, and document organization |
| Section 2 | The Related Documents provides a bibliography of parent, applicable and reference documents for the Release B Integration and Test Procedures Document |
| Section 3 | The Release B Integration and Test Overview describes the process used to integrate and test the segments, and subsystem interfaces |
| Section 4 | The Release B Test Cases describes the thread and build test cases, which will be used to verify the functionality of Release B |
| Section 5 | Release B Test Procedures describe the step by step test procedures of the specific segment and system level thread and build test cases |

- Appendix A The Level 3 and 4 Requirements Matrix contains a mapping of paragraph ID to the test cases and associated Level 3 and 4 requirements
- Appendix B The New Test Case to Old Test Case Matrix contains a mapping of test case names and numbers from this 322 document to the Release B System and Segment Integration and Test Plan
- Abbreviations and Acronyms This list contains a list of acronyms included in the document

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2. Related Documentation

2.1 Parent Documents

The parent documents are the documents from which this Release B CSMS Integration and Test Plan and Procedures' scope and content are derived.

101-CD-001-004	Project Management Plan for the ECS Project, DCN No. 1
107-CD-001-007	Level 1 Master Schedule for the ECS Project
194-201-SE1-001	Systems Engineering Plan for the ECS Project
319-CD-006-001	Release B Integration and Test Procedures for the ECS Project
322-CD-002-002	Release A Integration & Test Procedures for the ECS Project, Volume 1: CSMS, Preliminary
322-CD-005-002	Release A Integration & Test Procedures for the ECS Project, Volume 2: SDPS
194-401-VE1-002	Verification Plan for the ECS Project
402-CD-001-002	System Integration and Test Plan for the ECS Project, Volume 1: Interim Release 1 (IR-1)
402-CD-002-002	System Integration and Test Plan for the ECS Project, Volume 2: Release A
402-CD-003-001 CD-006-001	Release B System and Segment Integration and Test Plan for the 319-ECS Project
420-05-03	Earth Observing System (EOS) Performance Assurance Requirements for the EOSDIS Core System (ECS)
423-41-01	Goddard Space Flight Center, EOSDIS Core System (ECS) Statement of Work
423-41-03	Goddard Space Flight Center, EOSDIS Core System (ECS) Contract Data Requirements List Document

2.2 Applicable Documents

The following documents are referenced within this Plan and Procedures, or are directly applicable, or contain policies or other directive matters that are binding upon the content of this volume.

194-207-SE1-001	System Design Specification for the ECS Project
301-CD-002-003	System Implementation Plan for the ECS Project
304-CD-005-002	Release B System Requirements Specification for the ECS Project
305-CD-020-002	Release B SDPS/CSMS Design Overview for the ECS Project
305-CD-021-002	Release B SDPS Client Subsystem Design Specification for the ECS Project
305-CD-022-002	Release B SDPS Interoperability Subsystem Design Specification for the ECS Project
305-CD-023-002	Release B SDPS Data Management Subsystem Design Specification for the ECS Project
305-CD-024-002	Release B SDPS Data Server Subsystem Design Specification for the ECS Project
305-CD-025-002	Release B SDPS Ingest Subsystem Design Specification for the ECS Project
305-CD-026-002	Release B SDPS Planning Subsystem Design Specification for the ECS Project
305-CD-027-002	Release B SDPS Data Processing Subsystem Design Specification for the ECS Project
305-CD-028-002	Release B Communications Subsystem Design Specification for the ECS Project
305-CD-029-002	Release B CSMS System Management Subsystem Design Specification for the ECS Project
305-CD-030-002	Release B GSFC DAAC Design Specification for the ECS Project
305-CD-031-002	Release B LaRC DAAC Design Specification for the ECS Project
305-CD-033-002	Release B EDC DAAC Design Specification for the ECS Project
305-CD-034-002	Release B ASF DAAC Design Specification for the ECS Project
305-CD-035-002	Release B NSIDC DAAC Design Specification for the ECS Project
305-CD-036-002	Release B JPL DAAC Design Specification for the ECS Project
305-CD-037-002	Release B ORNL DAAC Design Specification for the ECS Project
305-CD-038-002	Release B System Monitoring and Coordination Center Design Specification for the ECS Project

305-CD-039-002	Release B Data Dictionary for the ECS Project Subsystem Design Spec
307-CD-004-001 329-CD-004-001	Release B Science Data Processing Segment (SDPS) Release and Development Plan for the ECS Project
307-CD-005-001 329-CD-005-001	Release B Communications and System Management Segment (CSMS) Release and Development Plan for the ECS Project
403-CD-002-002	Release B Verification Specification for the ECS Project
501-CD-001-004	Performance Assurance Implementation Plan (PAIP) for the ECS Project
604-CD-002-003	Operations Concept for the ECS Project: Part 2B - ECS Release B
222-WP-002-001	Release B Interface Requirements Analysis, White Paper for the ECS Project
423-41-02	Goddard Space Flight Center, Functional and Performance Requirements Specification [F&PRS] for the Earth Observing System Data and Information System (EOSDIS) Core System
505-41-13	Goddard Space Flight Center, Interface Requirements Document between Earth Observing System Data and Information System (EOSDIS) and the Landsat 7 System

2.3 Information Documents

2.3.1 Information Documents Referenced

The following documents are referenced herein and, amplify or clarify the information presented in this document. These documents are not binding on the content of this document.

102-CD-001-004	Configuration Management Plan for the ECS Project
193-103-MG3-001	Configuration Management Procedures for the ECS Project

2.3.2 Information Documents Not Referenced

The following documents although not referenced herein and/or not directly applicable, do amplify or clarify the information presented in this document. These documents are not binding on the content of this Test Plans and Procedures document.

311-CD-008-001	Release B SDPS/CSMS Database Design and Database Schema for the ECS Project
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313-CD-006-002	Release B CSMS/SDPS Internal Interface Control Document for the ECS Project
409-CD-002-001	ECS Overall System Acceptance Test Plan for Release B
160-TP-002-001	Version 1 Data Migration Plan for the ECS Project
222-TP-003-008	Release Plan Content Description for the ECS Project
194-WP-904-002	Multi-Track Development for the ECS Project

3. Release B Integration and Test Overview

This section contains an overview of the approach taken by the Release B Integration and Test Organization to ensure complete and thorough testing at the segment and system levels. Included is information concerning the I&T approach, verification activities, and responsibilities.

3.1 Release B I&T Overview

3.1.1 Functional Overview

ECS is comprised of three segments, each comprised of various subsystems. The three segments are the Flight Operations Segment (FOS), Science Data Processing Segment (SDPS) and Communications and System Management Segment (CSMS). Each of these segments are decomposed into subsystems and the subsystems are composed of CIs. This document provides the procedures for testing the design and implementation of the CSMS and SDPS CIs and their integration into ECS subsystems for Release B.

This sub-document, Volume 2: SDPS Procedures, focuses on the integration of SDPS subsystems. SDPS is composed of seven (7) subsystems. They provide the hardware and software resources needed to implement the SDPS functionality.

The Computer Software Configuration Items (CSCIs) and Hardware Configuration Items (HWCIs) for SDPS at Release B are listed in Table 3.1.1-1. Included are CI names and SDPS subsystems.

Table 3.1.1-1. SDPS Release B CIs (1 of 2)

CI	Subsystem Superclass
Desktop CSCI (DESKT)	Client (CLS)
Workbench CSCI (WKBCH)	Client (CLS)
Advertising Service CSCI (ADSRV)	Interoperability (IOS)
Advertising Service HWCI (ADSHW)	Interoperability (IOS)
Local Information Manger CSCI (LIMGR)	Data Management (DMS)
Distributed Information Manger CSCI(DIMGR)	Data Management (DMS)
Data Dictionary CSCI (DDICT)	Data Management (DMS)
Version 0 Interoperability Gateway CSCI (GTWAY)	Data Management (DMS)
Data Management HWCI (DMGHW)	Data Management (DMS)
Science Data Server (SDSRV)	Data Server (DSS)
Document Data Server CSCI (DDSRV)	Data Server (DSS)
Storage Management Software CSCI (STMGT)	Data Server (DSS)
Data Distribution Service CSCI (DDIST)	Data Server (DSS)
Access and Control Management HWCI (ACMHW)	Data Server (DSS)

Table 3.1.1-1. SDPS Release B CIs (2 of 2)

CI	Subsystem Superclass
Working Storage HWCI (WKSHW)	Data Server (DSS)
Data Repository HWCI (DPRHW)	Data Server (DSS)
Distribution and Ingest Peripheral Management HWCI (DIPHW)	Data Server (DSS)
Ingest Services CSCI (INGST)	Ingest (INS)
Ingest Client HWCI (ICLHW)	Ingest (INS)
Production Planning CSCI (PLANG)	Planning (PLS)
Planning HWCI (PLNHW)	Planning (PLS)
Processing CSCI (PRONG)	Data Processing (DPS)
Science Data Processing (SDP) Toolkit CSCI (SDPTK)	Data Processing (DPS)
Algorithm Integration and Test CSCI (AITTL)	Data Processing (DPS)
Science Processing HWCI (SPRHW)	Data Processing (DPS)
Algorithm Integration and Test HWCI (AITHW)	Data Processing (DPS)
Algorithm Quality Assurance (QA) CSCI (AQAHW)	Data Processing (DPS)

The Release B SDPS design evolves from the Release A design due to various factors, including additional requirements for Release B, new COTS selections, completion of trade studies and prototypes, changes to the technical baseline, and refinement of the object models. A summary of some of the major Release B SDPS additions or enhancements to the Release A design are summarized below in Table 3.1.1-2.

Table 3.1.1-2 SDPS Release B Changes and Enhancements to Release A Capabilities

Release B Enhancement	Release A Capability	Subsystems Affected
Continued full TRMM support, plus support for Landsat7, COLOR, AM-1, ADEOS II, SAGE III, RADAR ALT and ACRIM. Support for ERS, JERS and RADARSAT at ASF. Support for DAO at GSFC	Complete data handling/ processing of TRMM, CERES, and LIS instrument data. Interface testing for ASTER GDS to EDC DAAC; LPS to EDC DAAC; MODIS SCF to GSFC and EDC DAACs; and AM-1 MOPITT, MISR, and CERES SCFs to LaRC DAAC.	All
Greatly increased (by at least an order of magnitude) maximal network rates, data processing and required data product storage, especially for AM-1 mission support.	Moderate data rates, data processing and data storage requirements.	All
Two way interoperability with NOAA; increased access with GCMD/GCDIS)	One way interoperability with NOAA	CLS, DMS
More robust multi-DAAC planning and scheduling; support for inter-DAAC resource conflict resolution via use of common planning data; support for Targets of Opportunity (TOOs)	Basic inter-DAAC planning and scheduling	PLS
Replacement with V1 ECS client plus continued VO interoperability, VO 2-way interoperability	User of Release A Version 0 client capability, one-way interoperability	CLS, DMS
Enhanced local information management capabilities and implementation of distributed information management. Enhanced management reporting.	Basic local information and resource management.	DMS
More complex data searches, including multiple data set coincident searches.	Simple data searches	DLS, DMS, DSS
Enhanced processing on-demand in addition to simple storage and retrieval from archive.	No on-demand processing.	DPS, DSS
Robotic control of file servers; enhanced attached storage capability; client APIs for scientists to gain access to data storage and retrieval services.	Basic data storage and retrieval capabilities	DSS
Enhanced metadata capabilities - expandable metadata attributes and geographic metadata search - including WRS parameters.	Basic metadata generation and search.	DSS, DMS
Completion (by end of Release B operations) of data migration from V0. Increased capability to translate data to HDF.	Initiation of data migration from V0 and data translation to other formats	DSS
DAO data assimilation processing	Integration of Release A standalone environment	DPS, PLS
DARs	None	CLS, DPS, DSS
Ability to add Extended Data Providers	None	DMS

3.2 Release B I&T Testing Approach

3.2.1 Release B I&T Testing

The Release B I&T organization integrates and verifies SDPS and CSMS CI functionality on an phased basis. As incremental integration and testing proceeds, larger portions of the segments are assembled. The integration focuses on integrating functionally related components rather than on the structural decomposition achieved through the design process. As such, components from multiple CIs or segments may be integrated and tested early in the integration process. Therefore there is no strict delineation between CI, Segment, or System Integration and Test. An attempt has been made to delineate SDPS from CSMS based on the emphasis of the requirement verification activities.

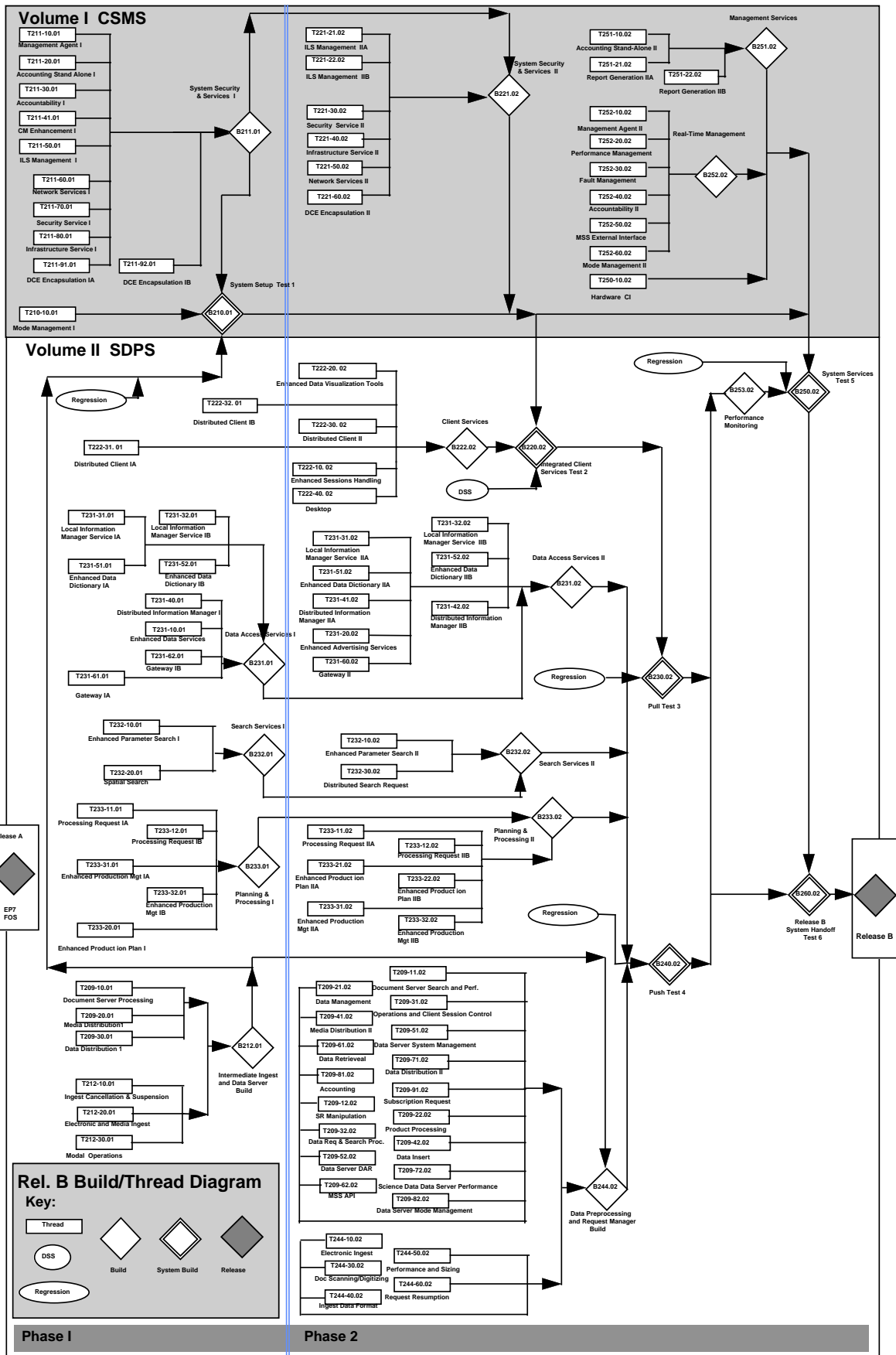
As unit testing on software and hardware items is completed, the I&T organization incrementally assembles lower-level functionality into progressively higher levels until a Release is completely integrated and tested. Functional components that are integrated are threads, and the result of combining threads is a build. Functional testing verifies Level 3 and 4 functional requirements.

3.2.2 Build/Thread Methodology

The build/thread concept, which is based on the incremental aggregation of functions, is used to plan I&T activities. A thread is the set of components (Software CIs, hardware and data) and operational procedures that implement a function or set of related functions. Threads are tested individually to facilitate Level 4 requirements verification and to isolate software problems. A build is an assemblage of threads to produce a gradual buildup of segment capabilities. This orderly progression of combining lower level software and/or hardware items to form higher level items with broader capability is the basis of CSMS and SDPS Release B integration.

Earlier Threads and Builds focus on demonstration of selected segment functionality and verification of primarily Level 4 requirements and are thus considered segment threads and builds. Later integration activities, primarily builds, demonstrate end-to-end system level functionality and verify primarily Level 3 requirements, thus they are considered system builds.

Build/thread diagrams are developed for each release. The build/thread diagram for Release B is presented in Figure 3.2.2-1. Threads and builds are defined by examining CIs, Level 4 requirements, the release implementation plan and segment/element design specifications. The Release I&T organization, with support from the development community, logically groups the release into functional categories divided along noticeable boundaries. These categories are the basis for threads. Threads are combined to define builds. Builds include several integrated threads and/or other builds functions. The build/thread diagram for each release acts as a framework for test case definition. From each build and thread on the diagram, test cases are developed. These test cases provide the basis for development of step-by-step test instruction to be documented as test procedures.



Volume 1 of this document contains the test cases for the threads and builds on Figure 3.2-1 that focus on CSMS functionality. These threads and builds explicitly integrate and test the functionality specified by most of the CSMS Level 3 and 4 requirements. Some CSMS requirements, such as external interfaces, are mapped to test threads or builds in Volume 2 to improve the efficiency of the verification approach.

Volume 2 of this document contains the test cases for the threads and builds on Figure 3.2-1 that focus on SDPS functionality. In addition to the explicit SDPS functionality verified in these threads and builds, they also integrate and test many CSMS components, such as CSS communication services, that are not shown on the figure.

Concurrent integration and verification of CSMS components in both the CSMS and SDPS threads and builds ensures these underlying critical components are thoroughly tested and improves system reliability. Isolated testing of CSMS functionality described in Volume 1 provides intensive testing and requirements verification of these service oriented components. Early integration of CSMS components with the SDPS applications that rely on their services reduces integration risk and driver development costs.

3.3 I&T Test Verification

The following sections define responsibilities and activities of the I&T organization. I&T verification includes definition of verification methods, post test analysis, regression testing, and verification resources.

3.3.1 Verification Methods

The four verification methods used for I&T include: inspection, analysis, demonstration, and test. They are defined in the ECS Verification Plan (ECS document number 194-401-VE1-002).

- a. Inspection. The visual, manual examination of the verification item and comparison to the applicable requirement or other compliance documentation, such as engineering drawings.
- b. Analysis. Technical or mathematical evaluation based on calculation, interpolation, or other analytical methods.
- c. Demonstration. Observation of the functional operation of the verification item in a controlled environment to yield qualitative results without the use of elaborate instrumentation or special test equipment.
- d. Test. A procedure or action taken to determine under real or simulated conditions the capabilities, limitations, characteristics, effectiveness, reliability, or suitability of a material, device, system, or method.

Each requirement is verified by one or more of these methods. A requirements matrix mapping Release B segment and system level requirements to Release B test cases, is provided in Appendix A of this document.

3.3.2 Post Test Analysis

Post analysis includes data reduction and comparison of actual results against expected results. Post test analysis required for I&T is performed by the I&T organization with support from system engineering or development organizations and the user communities when appropriate. Methods for performing post-test analysis are documented in the Segment/Element Integration and Test Procedures on a test by test basis. Results of post-test analysis is documented in I&T reports. Data, data logs, event logs and any other test output required for post test analysis is captured and stored under CM control.

3.3.3 Regression Testing

Regression testing is supplemental testing performed at any time upon any thread or build during I&T testing to ensure that existing software is not adversely affected by modified or new software. I&T members are responsible for planning, documenting, executing and reporting all regression testing. Automated test tools are used, when practical, for regression testing by the I&T organization. This ensures that regression tests duplicate initial test procedures.

For Release B, the following changes may result in regression testing:

- software changes
- hardware changes
- operational enhancements
- new versions delivered after the unit level testing

The I&T organization is responsible for reporting any discrepancies encountered during regression testing. Discrepancies resulting from any level of testing which result in modifications at the unit level, will be regression tested by the I&T organization.